Rec.Models.Rockets FAQ
(Frequently Asked Questions)

Part 12: Ignition and Launch System Tips

Posted: February 11, 1997

Last modified: January 9, 1997

[Note: This portion of the FAQ is maintained by Jerry Irvine
(jjirvine@cyberg8t.com).
All comments and suggestions should be sent to him.]

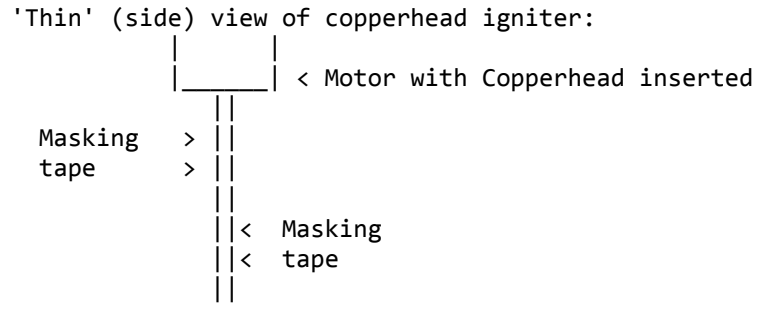
12.1 Copperhead, squib, electric match, thermalite, flash bulb. What are all these types of igniters, how much current do they require, and when are they used?

Copperhead	used to ignite single composite motors; not good for clustering. They will light most black powder motors. Requires strong 12V current source.
Electric Match	a type of electric igniter requiring little current to ignite. As little as 200ma of current will set them off. Used for igniting high power motors and motor clusters.
Thermalite	a type of fuse used extensively in pyrotechnic applications. May be ignited by nichrome wire or flash bulb. Plain thermalite ignited by nichrome wire is often used in black powder clusters.
Firestar	Igniter kit which has proven popular in general use and is easily shippable. Uses low or high current (6-12v) depending on which bridge wire you dip in the partially pre-mixed solution you buy.
Flashbulb/thermalite	some types of camera flashbulbs ignite with very little current (typically as little as 50ma) and burn very hot. These are used to ignite a piece of thermalite fuse running into the motor. Used for igniting high power motors and all forms of clusters.
Magnelite	medium to high current requirements. Sold by Rocketflite to ignite Silver Streak motors. Works well to ignite single high power motors. These are magnesium tipped igniters that burn at a very high temperature.

In general, almost any current source from a 1.5V 'C' battery up might ignite a flash bulb or electric match. For the other igniters, a 12V system capable of delivering several amps of current to the igniter is required.

12.2 How do those 'Copperhead' igniters work? They only have one wire?

Copperhead igniters are actually two strips of copper wire with a thin mylar insulating layer between them. To use these with regular alligator clips you need to use masking tape to insulate opposite sides of the igniter from each clip.



Attach one alligator clip at each masking tape point, so that each clip only makes contact with one (opposite) side of the igniter.

The Quest 'Tiger Tail' igniters are the same type of igniters as Copperheads. They come with a special 'wrapper' with openings for alligator clips.

NOTE: Copperhead igniters require a 12 volt ignition system.

12.3 I've heard that Copperhead igniters are 'unreliable' for igniting HPR

motors. Is that true?

Many HPR flyers do not like the Copperhead igniter, prefering alternatives when they can be found. It is certain that Copperhead igniters are not a good choice for igniting clusters. However, some have found the Copperhead to be a reliable igniter for single-motor HPR rockets.

From: dcrcep@mizzou1.missouri.edu (Elmer M. Price)
> Hi Folks: I have a comment on the reliability of Copperhead ignitors. Our small group has had no problems with these, once we figured out the best way to use them. So, in spite of all the negative comments, we actually really like these things. We have launched composites up to and including I-sized motors with great reliability. For example, two weeks ago, two of us (at the excellent St. Louis launch), launched two I284 birds, one I161, one I211, two H123 and a few F's and G's. We had 100% ignitor success.
>
> O.K. So what do we do to achieve such reliability? First, open the reload pack and assemble the motor in the usual manner. Second, find the Copperhead that came with the reload kit and THROW IT AWAY. What we use are Copperheads which we purchase separately. These arrive from the dealer (like Magnum) in a nice package and the ignitors are not all beat up and crimped and bent to heck like the ones which are provided in the reload kit. We feel this is an important point. Second, since the H and I (and larger) motors are a bit more difficult to light, we modify the new Copperhead as follows (this idea came from RMR): take a slug of white lightning propellant (we use the slug from a D9) and cut a very small sliver (and I mean small, about 1/16 inch square and about 1/2 inch long). Tape this sliver (Fred from our group optimized this point) to the Copperhead by overlapping the bottom half of the pyrogen on the Copperhead with the top half of the sliver. Use a small strip of masking tape to attach the sliver to the copper below the pyrogen. The point here is to ensure the tape is below the area where the pyrogen and the sliver overlap. This is important because if the tape is higher up the ignitor, the sliver may fall off of the Copperhead and lead to a chuff (ignition too far aft).
>
> This modification is not necessary for G and smaller motors, since the pyrogen is in close proximity (or touching) the propellant.

And this was added by: bday@fly.HiWAAY.net (Brian Day)
> I've also gotten *MUCH* better reliability from Copperheads by not using the red plastic cap over the nozzle, and just using a small piece of masking tape to hold the igniter in place. This technique doesn't crimp the Copperhead like the plastic cap does. Since doing this, I've gone from roughly 50% reliability to darned near 100%.
>
> Oh yeah, someone else on rmr recently suggested clipping off the pyrogen part of an old, crummy Copperhead and using it to augment another one, like you do with your sliver of propellant. Beats throwing it away...

Finally, regarding the red caps provided with Aerotech motors for holding in the igniters,

From: Bob Kunz (bkunz@boi.hp.com)
> You do know that one is supposed to provide a vent in the red cap? I would presume this is to allow some leakage of pressure but enough to get the white/blue/black propellant to ignite. Typically, I find that the red cap is blown through when I recover the rocket. Only once was it blown off at the launch pad. So far in about a dozen launches on RMS 24/80, I've had no failures. But sure those are small grains compared to some of the 54mm stuff.

From: curcio@telerama.lm.com (Larry Curico)
> Copper Head igniters have acquired reputations for unreliability. I'm wondering if the problem is in the igniters or in the red nozzle caps, which blow off during most Copper Head failures. IMHO, it's the sudden release in pressure that makes ignition fail - by disrupting the newly forming flame. When I use a piece of masking tape instead of a cap, I don't seem to have the problem.

Editor's note (jjirvine@cyberg8t.com):
> As of 11-96 Aerotech has made some efforts to eliminate the microshort problem which is an artifact of the Coppercrap manufacturing process. They have tried making versions with thicker insulator layers. While they are more fragile and subject to peeling, they are more reliable than before. Time will tell.

12.4 Do you have any specific suggestions or tips for an ignition power sources? Can I use my old Estes ignition system with composite models?

The Estes, Quest and other model rocket launch systems are fine for most model rockets. If you do a lot of flying there have been some suggestions posted to the net. If you are trying to launch cluster models with solar igniters you will need more 'juice' than 4 AA batteries can provide. This is also true of clustered Copperhead type igniters.

From: cdt@sw.stratus.com (C. D. Tavares)
> A motorcycle gel cell, however, will last a long, long time. Our club uses a gel-cell the size of three VHS tapes to launch 120 rockets over six hours, and it comes home at about 80% charge.

From: billn@hpcvaac.cv.hp.com (Bill Nelson)
> I bought a 12 volt motorcycle battery for about $20. I only need to recharge it 3 or 4 times a year. I have adapted all my launch controllers to allow usage of the battery.

12.5 WARNING: Be very careful using any ignition system with 'flashbulb' or electric match type igniters.

Many (most?) launch ignition systems are not 'flashbulb safe'. Just arming the circuit (i.e., doing a continuity check) will fire the flashbulbs and ignite the motor. If you plan to use flashbulb ignition often, you might consider investing in a 'flashbulb safe' ignition system.

From J.COOK@ens.prime.com (Jim Cook):
A lot of launch systems use a light bulb to do a continuity check. The current through the light bulb is enough to set off flash bulbs (They require only milliamps to fire).

Remember that electric matches may ignite on any amount of current above 200 miliamps. Flashbulbs may ignite with as little as 50 miliamps of current.

12.6 The ignition of rockets by other than electrical means is banned by both the NAR and Tripoli safety codes and should not be used.

There was a fairly lengthy discussion in r.m.r about the use of hand-lit fuse to launch rockets. Although there was an advocate of this method the consensus opinion of the net was that the NAR and Tripoli safety codes made good sense, hand-lit fuse igniters were unsafe, and electrical ignition (even if igniting fuse by electrical means) should be used for all activities. Hand-lit fuses are also against most state laws.

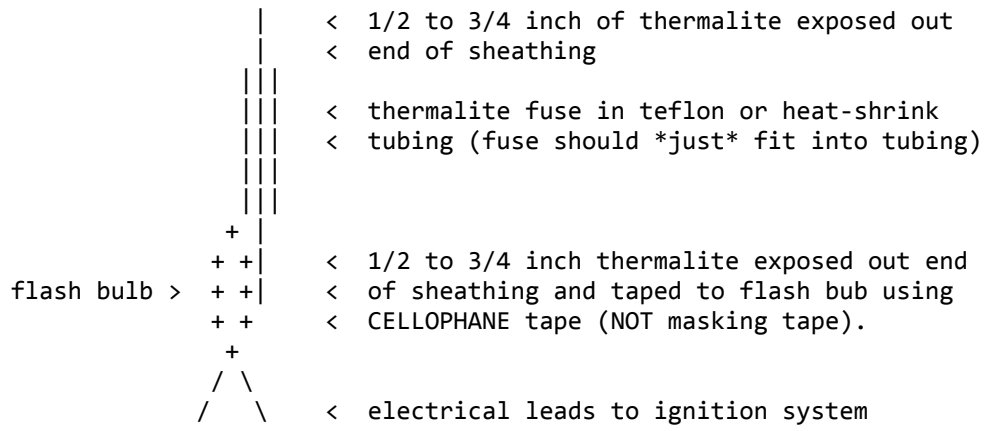
While it is theoretically safe and practical, it goes against the principal of self regulation which has made model rocketry legal and available natonwide and worldwide. Just don't do it.

12.7 What is thermalite fuse and how is it involved in igniting rocket motors?

Thermalite is a type of fuse that has been used in the pyrotechnics industry for a number of years. It comes in three burn rates, identifiable by the color of the fuse wrapping:

Color	Type	Burn Rate	Usage
Pink	Slow	20 sec/foot	Flashbulb ignition
Green	Medium	10/sec/foot	Ignition enhancer
White	Fast	5 sec/foot	Not used much in rocketry

The burn rates are approximate and vary with humidity, temperature, age of fuse, etc. The numbers also correspond to burn rates of exposed thermalite. When enclosed in heat-shrink or teflon tubing, all three types burn at an equally fast rate. A typical usage for thermalite is in a flash bulb igniter:


1/2 to 3/4 inch of thermalite exposed out
end of sheathing
thermalite fuse in teflon or heat-shrink
tubing (fuse should *just* fit into tubing)
1/2 to 3/4 inch thermalite exposed out end
flash bulb >
of sheathing and taped to flash bub using
CELLOPHANE tape (NOT masking tape).
electrical leads to ignition system

The fuse is sheathed except for about 3/4" at each end. The sheathed fuse is inserted into the motor and must be long enough for the exposed end to go all the way up through the core and out the bottom of the motor. Composite motors are ignited at the top of the core (nearest the delay charge). The sheathing on the fuse is to keep from igniting the motor anywhere but the correct location. The other end of the fuse is tape to a hot-burning flash bulb. The flash is then attached to the ignition system and ignited in the normal fashion. This lights the thermalite fuse, which then ignites the motor.

This is the ignition method of choice for clustered composite motors (in any number above 1) and large clusters of black powder motors.

WARNING: Flash bulbs require VERY LITTLE current to set them off. Read the warnings in 12.5, above.

NOTE: Thermalite is clasified by the BATF as a 'Class B Low Explosive'. Out of state purchase, interstate transport, and personal storage of *any* amount of thermalite fuse requires a Federal Low Explosives User Permit. Refer to the section on 'High Power Rocketry' for more details on LEUPs.

This is a change of prior enforcement practice and this material was widely available as a Class C item for decades. We will see how long this will last. Several advocates of easy access have suggested that short lengths of under 12" should be exempt from LEUP and shipping restrictions, especially those pieces included as stock igniters with MR and HPR motors from the factory.

Thermalite is one of those magic and critical substances to rocketry.

12.8 How do you ignite second stage composite motors? Can I use a black

powder booster for the first stage to ignite the second (as I do with multi-state A-D rockets)?

Upper stages of composite powered models may be ignited by electrical means or thermalite fuse. North Coast Rocketry has a Technical Report covering this subject. Excellent articles have also appeared in **Sport Rocketry/AmSpam** and HPRM magazines.

You cannot use a black powder booster to ignite a composite upper stage. The gasses from a BP booster will not properly ignite a composite. There are composite boosters on the market. These boosters are all 'plugged' and so cannot ignite any type of upper stage motor. Composite motors are mostly 'core burners' with the core running the entire length of the fuel grain. A composite core burner set up like a BP booster would ignite a BP upper stage too soon.

There are several issues involved in igniting upper stage composite motors. (1) A timing method must be provided to delay ignition until the appropriate time, (2) power source for the igniter is required and (3) the igniter itself must be provided and be capable of igniting high power motors. Whatever method of ignition is chosen, all 3 criteria must be met.

Timing Methods ....

Several methods of timing have been developed and used. The earliest and cheapest timing method is to use a length of unsheathed thermalite fuse. The fuse is typically ignited by the exhaust from the first stage motor. The fuse is long enough to allow for the first stage motor burn time and any desired post-burnout coast. The last portion of the fuse is sheathed and inserted into the upper stage motor to act as the igniter. The problem with this method is that not all thermalite burns at the same rate. Also, the same batch of thermalite will burn at different rates depending on the altitude, temperature and humidity at the time and place of launch.

Mercury switches were another early method of 'timing' upper stage ignition. A mercury switch is a small glass bulb with an enclosed drop of mercury. Two wires run out the top of the bulb. When the switch is tilted or decelerated the mercury rolls forward to make contact with the two wires and close the circuit. This results in a closed circuit when the booster motor stops firing and the rocket begins to decelerate. The ignition circuit would be set up so that power is provided to the igniter when the mercury switch closes. EXTREME care must be exercised when using mercury switches. Tilting the rocket closes the switch, so provisions for disarming the circuit must be included. After the rocket is placed on the pad and the circuit armed, any sudden movement of the rocket could set of the second stage.

Bob Weisbe uploaded plans for a mercury switch-based staging system that he used in a converted Estes Terrier-Sandhawk kit. The URL for these plans is:

http://sunsite.unc.edu/pub/archives/rec.models.rockets/PLANS/terrier_sandhawk.ps

The next generation of upper stage ignition systems were based on electronic timers of various types, both analog and digital. The timer was set for the appropriate time (first stage burn time + inter-stage delay, if any). A contact switch, usually kept open by the launch rod, would often be used to initiate the timer. As the rocket leaves the launch rod the timer is started. After the preset time interval the timer closes the circuit allowing power to the igniter. Again, great care must be taken with these devices. If the contact switch is allowed to close prior to the rocket lifting off the 2nd stage could ignite while the rocket is still on the pad and there are people around.

Another form of early timing device was based on photo-electric sensors. A sensor would be placed in a position such that light could get through the booster motor tube after all of the fuel was spent. When the sensor detects light the power circuit is closed.

Remote control has been used to initiate firing sequence in mutli-stage rockets. This method has the advantage that the 2nd stage isn't ignited unless a human being takes positive action, while the rocket is in the air. It also requires an R/C transmitter, receiver, etc.

Some newer devices are out based on acceleration detection. These are sometimes combined with timers. Liftoff acceleration is detected. This either starts a timer or enables a deceleration sensor. At the specified time interval, or when deceleration is detected, the power circuit is closed.

Power Sources ...

Two forms of electric power are commonly used, capacitors and batteries. A capacitor is typically charged from an external source just before liftoff. The timing device then closes the circuit at the proper time and the capacitor discharges, firing the igniter. One disadvantage of this method is that the capacitor charge slowly bleeds off, meaning that the rocket may not sit on the pad a long time after preping and still reliably ignite the upper stage(s).

All forms of small batteries have been used, depending on the power requirements. Common batteries for igniting a single, low power igniter are 9V transistor and 12V alkaline lighter batteries.

Timed thermalite fuse ignited by exhaust from the booster requires no power.

Igniters ...

Multi-stage rockets generally have a limited current source for igniting upper stages, so very low power igniters are used. Two common igeiters are electric matches and flash bulb/thermalite fuse. Both of these igniters are described elsewhere in this document.

Readers are encouraged to review the NCR technical reports and rocketry magazine articles on composite multi-staging.

A document describing igniters, and how one can make ignitors using thermalite and nichrome wire is available on the sunsite archive at:

http://sunsite.unc.edu/pub/archives/rec.models.rockets/ARTICLES/igniter_talk.txt

Illustrations for this document are also available for downloading:

http://sunsite.unc.edu/pub/archives/rec.models.rockets/ARTICLES/igniter_talk_figures.ps

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12.9 What is 'flash in the pan' ignition and for what is it useful in rocketry?

From: jjirvine@cyberg8t.com (Jerry Irvine)
[*Editor's note: This is paraphrased from Jerry's postings*]
Flash in the pan ignition is used to ignite clusters of small black powder rocket motors. It consists of a thin layer of black powder on a paper plate under the motor nozles. The powder is ignited via a regular model rocket igniter, such as an Estes Solar igniter. When the power ignites, the burning particles and hot gasses from the 'flash' ignite the motors.

It is used to ignite clusters of 7-469 motors and reduces the number of igniters needed to one.

12.10 I would like to perfect a method for reliable ignition of clustered multi-stage rockets. Any suggestions or tips?

From: Leviathan@nighthawk.medtechnet.com (Leviathan)
So would everyone else... but there's always that chance that something may fail when staging and/or clustering... and probably double the chance when staging & clustering. Therefore, my best advice to anyone attempting (large?) projects requiring staging/clustering is to invest in some sort of recovery system such as the Adept altimeters with deployment. In the case of staging... if the upper motor fails to ignite the altimeter will still deploy the upper stage chute(s) SAFELY with NO damage to the rocket. In a case were you're clustering and a motor (or 2, or 3....) fails to ignite in the cluster, and the rocket WILL fail to reach a safe altitude - or more precisely now WILL have a delay time that is TOO LONG - again the altimeter will SAFELY deploy the chute(s). IMO it's a small price to pay to protect a much larger investment of the rocket itself. As a matter of fact in my current project - a 1/4 scale 3 stage Argo D4/Javelin - each stage will carry it's own altimeter with the 3rd stage carrying the Adept OBC2 recording altimeter. Not only will this provide for dual deployment of each stage's recovery system, it should provide protection against failure of the 2nd and/or 3rd stage ignition. I also plan on carrying a Pratt system aboard to provide redundant back up.

From: John Dunbar (jdunbar@csd.sgi.com)
I really recommend the teflon sheathing method of thermalite.

Now you can try using a flash pan to get that first stage bohemian going. Its just a nice circular pan, with fine black powder in it. Just order a can from your local gun shop, they can ship US postal to your front door without a single eyelash batting on the face of a BATF agent. You stick those engine down into the power with a thermalite whick protruding from the engine, and WHOOSH...

The more parts you have to worry about, the greater the likelihood that something is going go terribly wrong. Now if you don't care, and just want to do it for fun, GO FOR IT, otherwise think of ONE BIG MOTOR for the first stage and one smaller, yet BIG MOTOR, for the second. Do not rely on mercury switches for high power ... thats a NO NO. Instead, use timers in a way that causes the second stage to start its ignition while the first is still under power. Now you can drag separate, and that's fine to, but make sure your bird is flying straight and true, or it will be doodoo!

Technical reports on this subject are available from NARTS and California Rocketry (see part02 of this FAQ):

California Rocketry report AIR-3

North Coast report NCTRA1 (from NARTS)

12.11 How do I cluster rocket motors? When igniting a cluster of rocket motors, should the igniters be wired in parallel or in series? Why?

The advent of composite model rocket motors in 'standard' black power sizes (18 and 24mm) has led to an increase in the use of composite motors in cluster rockets. Mixed black powder/composite clusters are also becoming popular. In particular, clusters of 3 or 4 composite motors, or a composite core motor with outboard black powder motors, are being seen more. These offer special ignition challenges. The old black powder techniques don't work when composite motors are involved. The most common method for clustering Estes type black powder motors is to use multiple Solar igniters and clip whips. Flash bulb to sheathed thermalite is the most common composite ignition

method. Although flash bulb ignition has been used for years, there have been safety concerns over its use. Here are some suggestions from rmr posters:

From PeteAlway@aol.com (Peter Alway):
I cluster black powder motors with Solar igniters wired in parallel and a car battery for power. I stuff igniters with little balls of tissue paper wadding to insure they stay in place. My general rule is only to cluster with a technique I use regularly for single-engine models, as reliability has more to do with experience and my current state of skill than with the particular technique.
[*Editor's note: Estes plastic plugs work well in place of tissue wads. The igniter plugs can be reused several times, as well.*]

From: glenn@lightning.nsc.com (Glenn Newell)
My technique for clustering composite motors is to use equal length pieces of thermalite with 1/16" heat shrink tubing as a sleeve. I leave about a 1/2" unsheathed in the motor and about one inch unsheathed on the other end (I don't shrink the heat shrink, it just happened to be around and the right size). I tape all the ends together around a single solar igniter. No flashbulb problems here!

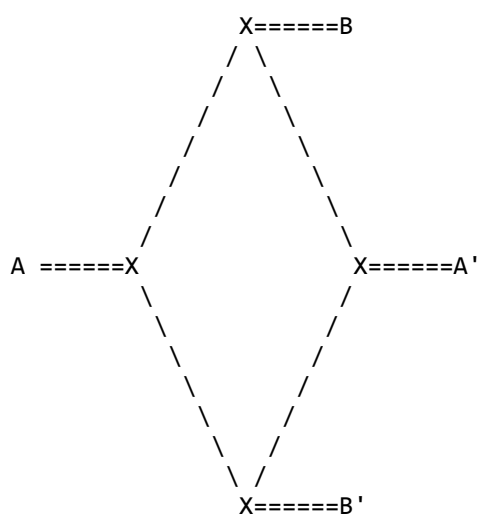
From: billn@hpcvaac.cv.hp.com (Bill Nelson)
I prefer to use a short section of Thermalite, with igniter wires, inserted into each motor - the wires are taped to the motor for security. There is no need for an igniter for the Thermalite. Simply remove the cloth wrap, and all but one of the spiral metal wires. Wrap the end of one wire to one end of the thermalite and the end of the other wire to the other end. You can use anything from about 22 gauge wire (if it will fit in the grain slot) to about 28 gauge. The free ends connect to the controller ignition wires. When the relay closes, the Thermalite wire wrap is essentially vaporized instantly. I have never seen the Thermalite fail to ignite.

From: burkefj@kodiak.ee.washington.edu (Frank J. Burke)
The main reason for using parallel igniters is that as one ignites, the others are still in the circuit. As one igniter breaks in a series circuit the circuit is broken and the others will not get any more current. It may be that with a 12V system, and low impedance wire, that the current provided is high enough that they flash so fast that it doesn't matter.... I have never had a failure with parallel circuits. I ... prefer using a parallel system, knowing the limitations, using a meter to verify that the igniters are "good" before using them, and using good connections when wiring them up.

From: buzzman@netcom.com (Buzz McDermott)
The biggest concern with wiring cluster igniters in series is that one igniter might burn through and break the circuit before all of the igniters have fired. Once the circuit is broken, no more igniters will fire.

On the other hand, it was mentioned by several posters that series wiring is extensively used in the explosives and pyrotechnics industries because of the added reliability you get. With series wiring you can verify the complete igniter circuit and you will know if *any* igniter is improperly wired. Also, you would be able to ignite many more (fast igniting) igniters with series wiring, especially if the resistance in the igniter is high.

From: kaplow_r@eisner.decus.org (Bob Kaplow)
For a 4 engine cluster I like to wire the ignitors in a "bridge":



Clips A and A' come from one clip whip. B and B' are from the other whip. I use a manual wire wrap tool for twisting the Solar ignitors together AFTER installing the "earplug" (tm). Be sure your wraps are nice and tight so they all touch where they are supposed to. Having a clip on each joint certainly helps. For multiple wire clipping, I've found that the clips with teeth hold better than the standard micro-clips.

I've used this several times now on 4xD12 in a BT-80 rocket with 100% success.

Editors Note:
The bottom-line-consensus of the 'net' seems to favor parallel wiring for most clusters of 7 or fewer motors, using a 12V (or more) launch system capable of dumping plenty of amps to the igniters. This generally means a relay based system with the primary ignition power source close to the launch pad.

Readers are also directed to check out the NCR Technical Reports #1 &

#2, on black powder and composite clustering, respectively. Although they are a few years old, they still contain valuable information.

12.12 I am new to rocketry. I was wondering whether anyone has tried using waterproof wicks instead of igniters to ignite a rocket engine.

The main application for Green fuse in rocketry is as an auxuliary delay when a timer is not available and Thermalite is too fast burning. Green Visco fuse burns about 30 seconds per foot.

From: kaplowro@hccompare.com
"Green" fuse isn't reliable, and unless electrically ignited via remote control (difficult) isn't legal. To use fuse and a match is a violation of the safety code, and most state local regulations.

buzzman@netcom.com (Buzz McDermott) adds to the above:
The most common way to use 'green' fuse or Jetex wick to ignite a model rocket motor is to cut a fair length, insert it in the motor, light it with a match, and RUN!. As Bob stated, it's against EVERYONE's safety code to do that. The answer to 'why' is simple. Once you light the fuse you've lost all control over launching the rocket. If a breeze kicks it over just before ignition you end up launching a land shark. You can't stop the launch if you notice a plane come out of nowhere and fly right overhead. You can't stop the launch if a little kid comes out of nowhere and runs up to your rocket. ...on top of all this, the stuff just really work all that well for rocket ignition...

12.13 The alligator clips on my launch system have worn out. What should I use to replace them?

From: msjohnso@KS.Symbios.COM (Mark Johnson)
RatShack is fine for clips...and they have a wide collection of sizes. My suggestion, having been-there-done-that and replaced clips on several controllers almost annually, is NOT to buy the little 3/4 inch copper clips. They're too delicate for my tastes. Instead, I get the chrome plated ones about 1 1/4 inches long, preferably with the little plastic grips on the "handles." These are bigger and thus easier to manipulate while wearing gloves, or when your hands are cold and unsteady.

If you use your launch system frequently, I recommend at least annual replacement of the clips. This is more true of a club system than an individual one, but remember that you take your choice of corrosives with model rocket motors -- black powder leaves just a bit of sulfuric acid in its wake, and composites drop hydrochloric. The clip bodies of copper micro-clips will hold up OK, but the spring that holds the jaws shut is steel and will eventually corrode away, as you've seen.

12.14 Other Ignition Tips:

From: dwade@jarthur.claremont.edu (Doug Wade)
[concerning adapting launch controllers to 12V car batteries ...]
Speaking of which, I took my Aerotech launch setup, lopped off the igniter attachment, and the place where it attaches to the battery, put amp plugs on either end, put a plug on the battery, and made some alligator clips in various configurations for launching Estes stuff. This means that I can switch batteries and igniter style in basically no time at all. It's not a lot of work, and it makes life easier. If you have the urge to do this kind of thing, make sure that you get plugs that can handle it. A 12V motorcycle battery (Mine was about $40 but it's pretty nice) can put out something like 15A for a short period of time...

From: cdt@rocket.sw.stratus.com C.D. Tavares
[concerning an ongoing discussion about blast deflectors]
I've had first hand experiences with several types of metals. I've never found a piece of aluminum that was worth dog-doo as a deflector. In the higher engine ranges, even steel will give you problems, especially with maintenance. Stainless isn't much help, since it still cruds up.

What we use are discarded grinding wheels. Fireproof, non-conductive, free, plentiful, large, and pre-drilled. The only negative on these is that when an engine catos they tend to lose large chunks or crack in half. This happens to us maybe three times per year, but as I say, they're free and they're plentiful.

From: kaplowro@hccompare.com (Bob Kaplow)
Use clay flower pots for blast deflectors. Get Stainless steel for launch rods from welding or metal supply houses.

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